Northern Ireland Assembly

Research and Information Service Briefing Note

Paper 88/14 17 April 2014 NIAR 266-14

James Stewart

Primary Science: Teaching Time and Enquiry-Based Learning

Summary

The 2011 Trends in International Mathematics and Science Study (TIMSS) report indicates that 10 year old pupils in Northern Ireland receive an average of 72 hours of science teaching time per annum. This is 13 hours below the international average.

Pupils in England receive slightly more (76 hours) science time than those in Northern Ireland. Pupils in the Republic of Ireland receive less (63 hours) than those in Northern Ireland. The country with the greatest allocation of science education time is Portugal (162 hours). In contrast, pupils in the Netherlands receive 42 hours of science education per annum.

TIMSS reports on enquiry-based learning by measuring how many teachers emphasise science investigation in *"About Half the Lessons or More".* The report indicates that 13% of pupils in Northern Ireland are taught by teachers who emphasise science investigation in *"About Half the Lessons or More".*

This is below the international average (40%), England (41%) and the Republic of Ireland (43%). It is, however, similar to Finland, the third highest performing country in science.

1. Trends in International Mathematics and Science Study

Trends in International Mathematics and Science Study (TIMSS) is a global research project which takes place every four years. It provides data about trends in mathematics and science achievement over time. TIMSS assesses the knowledge and skills of pupils around the world, and enables researchers to collect information about the quantity, quality, and content of teaching. This information can be used to make comparisons between participating countries. Findings from the survey are used to inform education policy and to improve teaching and learning in mathematics and science.[1]

2. Science Teaching Time in Primary Schools

TIMSS investigates overall annual school instruction hours and the time allocated to teaching science. Teaching time is calculated using the formula outlined in Figure 1.

Figure 1: Teaching Time Calculations

A sample of school Principals and class teachers were surveyed to calculate the following:

Total Instructional Hours per Year	=	Principal Reports of School Days per Year	x	Principal Reports of Instructional Hours per Day
Hours per Year for Instruction in Science	=	Teacher report of Weekly Science Instruction hours / Principal Reports of School Days per Week	x	Principal Reports of School Days per Year

The 2011 study reports that the **international average** of hours per year allocated to science teaching for 10 year old pupils is **85 hours**. In **Northern Ireland** the time allocated to science teaching is **72 hours**; 13 hours below the international average.[2]

Countries which reported **higher than average** levels of time allocated to science teaching time include:

- Portugal 162 hrs per year
- Thailand 109 hrs per year
- United States 105 hrs per year
- Finland 98 hrs per year
- Japan 91 hrs per year

[1] TIMSS Website: available at http://timssandpirls.bc.edu/timss2011/index.html

[2] Martin, M.O., Mullis, I.V.S., Foy, P., & Stanco, G.M. (2012). TIMSS *International Results in Science 2011* Boston: International Study Center, Boston College

Countries which reported **below average** levels of time allocated to science teaching include.

- England 76 hrs per year
- Germany 75 hrs per year
- **Northern Ireland 72 hrs per year**
- Ireland, Rep. of 63 hrs per year
- Netherlands 42 hrs per year

3. Emphasis on Science Investigation: 10 Year old Pupils

It is argued that there is a positive relationship between inquiry-based learning and student understanding and retention of science content. In particular, drawing conclusions from data and taking part in hands-on experiments have been associated with meaningful learning[3].

TIMSS 2011 summaries how often, in teaching science, teachers ask students to engage in the following six activities (associated with investigative science):

- Observe natural phenomena such as the weather or a plant growing and describe what they see
- Watch the teacher demonstrate an experiment or investigation
- Design or plan experiments or investigations
- Conduct experiments or investigations
- Give explanations about something they are studying
- Relate what they are learning in science to their daily lives

3.1. International Comparison

The use of inquiry activities varies widely across countries. The percentage of 10 year old students taught by teachers who emphasise science investigation in "*About Half the Lessons or More*" varies from 4% in Norway to 86% in Tunisia.

On average 40% of students were taught by teachers who emphasise science investigation in "*About Half the Lessons or More"*.

The results indicate that 13% of pupils (aged 10) in Northern Ireland were taught by teachers who emphasised science investigation in "*About Half the Lessons or More"*. This was **considerably below the international average**, and lower than in England

[3] Minner, Levy, & Century, (2009) *Inquiry-based science instruction* :Journal of Research in Science Teaching Volume 47, Issue 4, pages 474–496

(41%) and the Republic of Ireland (43%). It was however, similar to Finland (13%); the third highest performing country in science.

The report indicates that there is a greater emphasis on science investigation in Korea; the highest performing country in science, reported that 58 % of pupils are taught by teachers who emphasised science investigation in *"About Half the Lessons or More".*

There are no clear associations between teachers' emphasis on science investigation and pupils' average achievement *within* Northern Ireland. Indeed, average achievement of pupils appears to have been lower for those whose teachers emphasised science investigation in "*About Half the Lessons or More"*, compared to those for whom it was emphasised in "*Less Than Half the Lessons"*. The report suggests that this difference is unlikely to be statistically significant.[4]

This was not the case in Australia; the average achievement of pupils whose teachers emphasised science investigation in "*About Half the Lessons or More"* was 24 points higher than that of pupils whose teachers emphasised science investigation to a lesser extent.[5]

The full range of results is available at the following url: http://www.nfer.ac.uk/publications/PRTI01/PRTI01Ch8.pdf **(please copy and paste into your internet browser)**

[4]National Foundation For Education Research Website: Available at http://www.nfer.ac.uk/publications/PRTI01/PRTI01_home.cfm

[5] As Above